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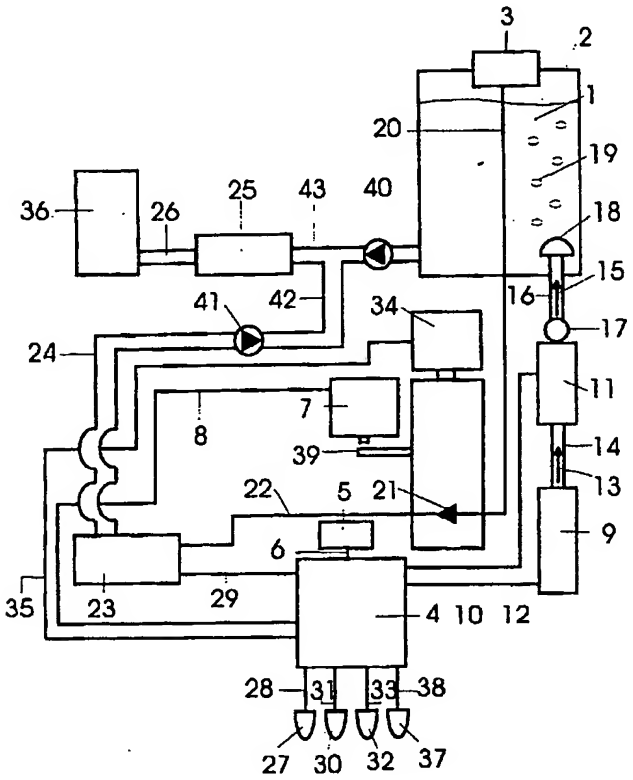
(54) **METHODE ET APPAREIL POUR CONCENTRER UN GAZ A L'AIDE D'UNE ZONE D'ADSORPTION A UN ETAGE**

(54) **METHOD AND APPARATUS FOR CONCENTRATING A GAS USING A SINGLE STAGE ADSORPTION ZONE**



(57) A method for treating a liquid with a gas comprises introducing a liquid to be treated into a treatment vessel, introducing a gas to treat the fluid into the treatment vessel and treating the fluid in the treatment vessel, pressurizing the treatment vessel and, using the pressure in the treatment vessel to dispense the treated liquid from the treatment vessel through a filter. An apparatus for treating the liquid is also disclosed.

Title: METHOD AND APPARATUS FOR CONCENTRATING A GAS USING A SINGLE STAGE ADSORPTION ZONE

FIELD OF THE INVENTION

This invention relates of an apparatus for treating a liquid such as water with a gas such as ozone. The apparatus may be used in the production of water fit for human consumption from water contaminated by microorganisms, chemicals, heavy metals and minerals. The gas may be present either by itself or in combination with one or more other gasses and/or a liquid. Further, the liquid with which the gas is reacted may be present by itself or may also have one or more liquids and/or one or more other gases associated therewith.

BACKGROUND OF THE INVENTION

The production of water fit for human consumption from water contaminated by microorganisms, chemicals, heavy metals and minerals is a requirement throughout the world. Many different proposals have been made for the purification of contaminated water.

The most popular system in widespread use for the purification of contaminated water is a pitcher wherein contaminated water is passed through a filter made of a combination of a porous media filter, activated carbon, and an ion exchange resin and into a clean water reservoir within the pitcher. This type of system will reduce the levels of chlorine, lead, and pesticides. However, there are several disadvantages associated with this device. The first disadvantage of this water purification system is that the structure of the filter provides a breeding ground for microorganisms thereby multiplying the dangers of microorganisms which may be present in very low numbers. Another disadvantage of such a water purification system is that the filter life is not measured and it is possible for the user to employ

the filter beyond its useful life. A further disadvantage of such a water purification system is that oils and fuels often present in water drawn from lakes and rivers are not readily removed and that said oils and fuels tend to coat the filters and damage their operational life and effectiveness. Some filtration based products now incorporate a means of measuring the water volume passing though the filter and an indicator as to when to change the filter. Other filters incorporate an iodine product to minimize the risk of microbiological hazards, however, these materials often impart undesirable tastes and many are potential carcinogens.

Another popular system in use for the purification of contaminated water is a system which employs an ultraviolet light for disinfection in series with a porous media and carbon filter. This type of system will reduce the levels of chlorine, lead, and pesticides and has some disinfection capability. However, there are several disadvantages associated with this device. The first disadvantage of this water purification system is that the ultraviolet light's disinfection efficacy is greatly diminished by turbidity or color in the water which can cause the filter to become contaminated by microorganisms which can readily live and breed therein thereby multiplying the danger from any microorganisms which may be present. Another disadvantage of such a water purification system is that the filter life is not measured and it is possible for the user to employ the filter beyond its useful life. A further disadvantage of such a water purification system is that oils and fuels often present in water drawn from lakes and rivers are not readily removed and that said oils and fuels tend to coat the filters and damage their operational life and effectiveness. Some filtration based products now incorporate a means of measuring the water volume passing though the filter and an indicator as to when to change the filter. Other filters incorporate an iodine product to minimize the risk of

microbiological hazards, however, these materials often impart undesirable tastes and many are potential carcinogens.

Clearly therefore, it is desirable that the design of a water purification system will employ a filtration stage prior to ozone, ozone for disinfection and oxidation, and a post ozone filtration stage to remove any residual ozone and products of ozonation from the water before consumption. It is also desirable that the design of a water purification system will employ a means of ensuring disinfection efficacy. It is also desirable that the design of a water purification system will employ a means of monitoring the filter usage and provide the user with an indication to change the filter.

SUMMARY OF THE INVENTION

In accordance with the instant invention, there is provided an apparatus for treating a liquid with a gas comprising:

(a) a treatment vessel having a gas inlet port for supplying a pressurized gas to the vessel and an outlet port;

(b) a filter downstream of the treatment vessel;

(c) a dispenser downstream from the filter for dispensing the treated liquid from the vessel; and,

(d) a passageway connecting the outlet port in flow communication with the dispenser, the passageway having a valve for isolating the dispenser from the vessel while the liquid is being treated

whereby the pressure in the vessel at the end of the treatment of the liquid is sufficient to drive the treated liquid through the filter and through the dispenser.

In one embodiment, the apparatus also comprises a gas outlet valve for venting gas from the vessel while the liquid in the

vessel is being treated.

In accordance with the instant invention, there is also provided a method for treating a liquid with a gas comprising:

(a) introducing a liquid to be treated into a treatment vessel;

(b) introducing a gas to treat the fluid into the treatment vessel and treating the fluid in the treatment vessel;

(c) pressurizing the treatment vessel; and,

(d) using the pressure in the treatment vessel to dispense the treated liquid from the treatment vessel through a filter.

In one embodiment, the method further comprises venting gas from the vessel while the liquid in the vessel is being treated.

In one embodiment, the liquid comprises water and the gas comprises ozone and the apparatus and method may be used for treating water, such as to obtain potable water or to treat water that has already been treated, such as municipally treated drinking water.

In another embodiment, the apparatus may also include sensors for monitoring the degree of treatment of the water and to advise the user when the treatment cycle is successfully concluded and/or to advise the user if the treatment cycle was not completed according to a set of preset instructions built into a controller.

BRIEF DESCRIPTION OF THE DRAWINGS

A further, detailed description of the invention, briefly described above, will follow by reference to the following drawings of a preferred embodiment of the invention in which:

Figure 1 shows a schematic representation of the apparatus according to the instant invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Figure 1 illustrates a means for treating a liquid with a gas. In a preferred embodiment, the liquid comprises water and the gas comprises zone. Accordingly, the apparatus may be used for purifying and disinfecting water by means of ozone gas.

Water 1 is introduced into container 2 through a resealable cap 3 mounted affixed to the container 2 (such as by a screw thread or a bayonet mount), and the resealable cap is closed.

The unit is provided with a source of oxygen. This may be the ambient air. Preferably, oxygen enriched air is used. Accordingly, the unit may be connected to a source of oxygen enriched air or, preferably, the unit may include an oxygen concentrator, such as those which utilize pressure swing adsorption and are known in the art. Pressurized air may be provided to an oxygen concentrator such as by a motor driven fan (not shown).

The control circuit 4 of this device derives power, eg. from a battery 5, by means of wire 6. The consumer may activate the unit by pressing the start button 7 which sends a signal to the control circuit 4 through the wire 8. This also causes the off gas flow control valve 21 to be open, preferably by mechanical means, in the event that it is closed by means of a lever 39. This also causes the control circuit to begin to time the cycle and the power light 27 to be turned on by means of wire 28. This further causes the control circuit 4 to provide power to the oxygen rich gas source, eg. air and preferably oxygen enriched air as may be obtained using a pressure swing oxygen concentrator, 9 through wire 10, and to the ozone generator 11 through wire 12.

The pressurized gas containing oxygen 13 then flows from the oxygen rich gas source 9 through tube 14 and into the ozone generator 11 where at least a fraction of the oxygen present is

converted to ozone. This ozone oxygen mixture 15 then flows through the pipe 16, through the one way check 17 and into the water 1 through the sparger 18 which serves to disperse the gas into fine bubbles 19. The vent line 20 from container 2 removes the gas from the head space and prevents pressure from building up in the container 2. The vent gas passes through the off gas flow control valve 21 and through tube 22 and into the ozone off gas sensor 23 through pipe 24, through check valve 41 through a portion of tube 43 and through the carbon block filter 25 and into the treated water carafe 36 from where it may pass into the room as oxygen rich gas. Thus, the ozone off gas may serve to disinfect the carbon block filter 25 and prevent microbiological growth within the filter.

The signals from the ozone sensor 23 are transmitted to the control circuit by wire 29. The control circuit 4 monitors the ozone off gas concentration by means of sensor 23.

If the off gas concentration rises too rapidly, the control circuit detects this as a fault and may shut down the power to the power light 27 by means of wire 28, the power to the oxygen rich gas source 9 through wire 10, and the power to the ozone generator 11 through wire 12. It may also cause the system fault light 30 to be illuminated by means of wire 31. Depressing the water dispense button 34 will send a signal to the control circuit 4 by means of wire 35 but said input will have no effect as the existence of a system fault precludes permission to dispense the water from the container 2 to the treated water carafe 36.

If the off gas concentration rises too slowly and does not achieve the preset concentration for the preset time within a preset time period, the control circuit means detects this as a fault and may shut down the power to the power light 27 by means of wire 28, the power to the oxygen rich gas source 9 through wire 10, and the power to the ozone generator 11 through wire 12. It may also cause

the bad water light 32 to be illuminated by means of wire 33. Depressing the water dispense button 34 will send a signal to the control circuit 4 by means of wire 35 but said input will have no effect as the existence of an unsatisfactory treatment condition illustrated to the consumer by light 32 being activated precludes permission to dispense the water from the container 2 to the treated water carafe 36.

If the off gas concentration rises as planned, and reaches the preset concentration for the preset time within a preset time period, the control circuit means detects this as a successful completion of the water treatment process and may shut down the power to the power light 27 by means of wire 28, the power to the oxygen rich gas source 9 through wire 10, and the power to the ozone generator 11 through wire 12. It may also cause the water ready light 37 to be illuminated by means of wire 38. Depressing the water dispense button 34 wills send a signal to the control circuit 4 by means of wire 35 but said input will cause the off gas flow control valve 21 to be closed, preferably by a mechanical member, and the oxygen rich gas source 9 to powered through wire 10. This in turn causes pressure to build up within the container 2 which causes the spring loaded check valve 40 to open. This then allows the treated water to flow through tube 43 and through the carbon block filter 25 and into the treated water carafe 36.

If the consumer depresses the dispense button during the delivery of water to the treated water carafe 36, then a signal is sent to the control circuit 4 by means of wire 35 but said input will cause the off gas flow control valve 21 to be mechanically opened and the oxygen rich gas source 9 to lose power through wire 10 thereby interrupting the dispensing process. Alternately, once a preset amount of time has elapsed during the dispense cycle, the control circuit means will interrupt power to the oxygen rich gas

source 9 through wire 10 thereby ending the dispensing process.When the customer depresses the start button in the future, the mechanical off gas flow control valve 21 will be reset to the open position for the next cycle to proceed.

In one embodiment, when the filter has treated a preset number of batches, the control circuit causes the filter light to flash warning the consumer that the filter must be changed soon. After a further preset number of cycles, the control circuit may also cause the filter light to be illuminated warning the consumer that the filter must be changed and that no further water will be dispensed until the filter has been replaced. A micro-switch 44 mechanically in contact with the filter housing 25 signals the control circuit means by a wire 45 when the filter has been removed and replaced.

WE CLAIM

1. An apparatus for treating a liquid with a gas comprising:

(a) a treatment vessel having a gas inlet port for supplying a pressurized gas to the vessel and an outlet port;

(b) a filter downstream of the treatment vessel;

(c) a dispenser downstream from the filter for dispensing the treated liquid from the vessel; and,

(d) a passageway connecting the outlet port in flow communication with the dispenser, the passageway having a valve for isolating the dispenser from the vessel while the liquid is being treated

whereby the pressure in the vessel at the end of the treatment of the liquid is sufficient to drive the treated liquid through the filter and through the dispenser.

2. The apparatus as claimed in claim 1 further comprising a gas outlet valve for venting gas from the vessel while the liquid in the vessel is being treated.

3. A method for treating a liquid with a gas comprising:

(a) introducing a liquid to be treated into a treatment vessel;

(b) introducing a gas to treat the fluid into the treatment vessel and treating the fluid in the treatment vessel;

(c) pressurizing the treatment vessel; and,

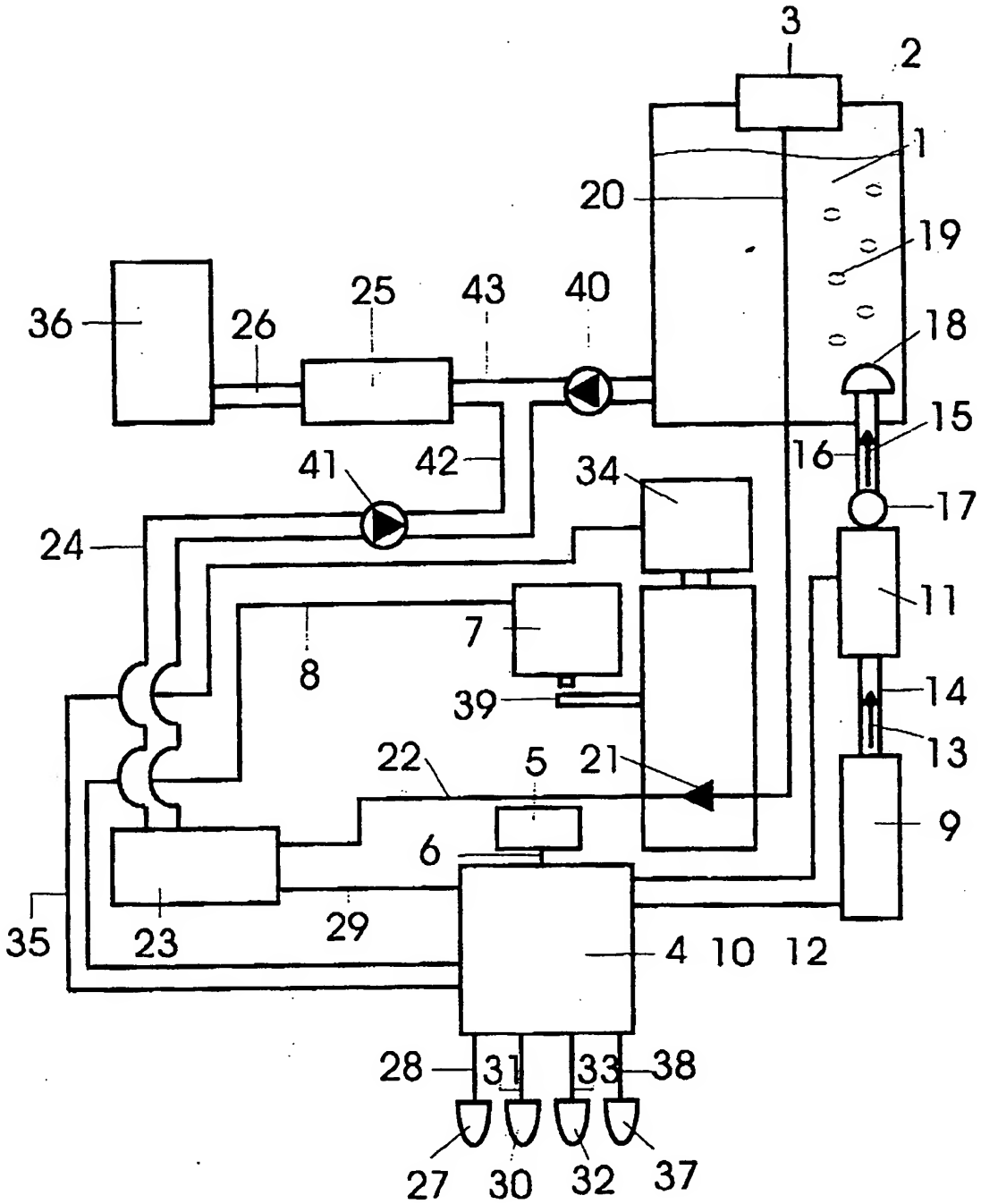
(d) using the pressure in the treatment vessel to dispense the treated liquid from the treatment vessel

through a filter.

4. The method as claimed in claim 3 further comprising venting gas from the vessel while the liquid in the vessel is being treated.

ABSTRACT OF THE DISCLOSURE

A method for treating a liquid with a gas comprises introducing a liquid to be treated into a treatment vessel, introducing a gas to treat the fluid into the treatment vessel and treating the fluid in the treatment vessel, pressurizing the treatment vessel and, using the pressure in the treatment vessel to dispense the treated liquid from the treatment vessel through a filter. An apparatus for treating the liquid is also disclosed.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